CLAIMS:

1. An object detection apparatus for detecting an object on a reference plane, wherein relative positions of the object and the object detection apparatus change on the reference plane, the apparatus comprising:

an image pickup device, which captures an image in a predetermined image pickup area, thereby obtaining image data;

an image cutting section, wherein the image cutting section cuts an image received by the image pickup device such that the image pickup device receives an image that is divided into a reference plane image and an object image by a predetermined boundary, wherein the reference plane image contains the reference plane, and wherein the object image contains the object and does not contain the reference plane;

a computer, wherein, from image data obtained by the image pickup device, the computer obtains reference plane image data corresponding to the reference plane image and object image data corresponding to the object image, and wherein the computer computes relative positions of the object and the object detection apparatus on the reference plane based on an optical flow obtained from the reference plane image data and an optical flow obtained from the object image data.

2. The object detection apparatus according to claim 1, wherein the object detection apparatus is mounted on a mobile unit that moves on the reference plane, and wherein the computer computes an amount of movement of the mobile unit based on an optical flow obtained from the reference plane image data.

3. The object detection apparatus according to claim 2, wherein the computer obtains a plurality of optical flows from the reference plane image data, and wherein, by performing

Hough transform using the coordinates of the start points and the coordinates of the end points of at least two of the obtained optical flows, the computer computes the amount of movement of the mobile unit.

4. The object detection apparatus according claim 2, wherein the computer computes a distance from the mobile unit to the object based on an optical flow obtained from the object image data and the computed amount of movement.

5. The object detection apparatus according to claim 1, wherein the image cutting section includes a reflecting body having a reflecting surface, and wherein the reflecting surface is located in a part of the image pickup area of the image pickup device.

6. The object detection apparatus according to claim 5, wherein the object image received by the image pickup device is an image that is reflected by the reflecting surface.

7. The object detection apparatus according to claim 5, wherein an angle θ1 of the reflecting surface relative to the reference plane is half an angle θ2 of an optical axis extending from the image pickup device toward the reference plane.

8. The object detection apparatus according to claim 7, wherein the angle θ2 is 90°.

9. A distance measuring apparatus, wherein the apparatus is mounted on a mobile unit that moves on a reference plane, and measures a distance from the mobile unit to an object, the apparatus comprising:

an image acquisition section, wherein the image acquisition section obtains a reference plane image and an

object image, wherein the reference plane image contains the reference plane, and wherein the object image contains the object and does not contain the reference plane;

a movement amount computation section, wherein the movement amount computation section computes an amount of movement of the mobile unit based on an optical flow obtained from the reference plane image; and

a distance computation section, wherein the distance computation section computes a distance from the mobile unit to the object based on an optical flow obtained from the object image and the amount of movement of the mobile unit computed by the movement amount computation section.

10. The distance measuring apparatus according to claim 9, wherein the image acquisition section includes:

an image pickup device, which captures an image in a predetermined image pickup area, thereby obtaining image data; and

an image cutting section, wherein the image cutting section cuts an image received by the image pickup device such that the image pickup device receives an image that is divided into the reference plane image and the object image by a predetermined boundary.

11. The distance measuring apparatus according to claim 10, wherein the image cutting section includes a reflecting body having a reflecting surface, and wherein the reflecting surface is located in a part of the image pickup area of the image pickup device such that the object image received by the image pickup device is an image that is reflected by the reflecting surface.

12. The distance measuring apparatus according to claim 11, wherein an angle θ1 of the reflecting surface relative to the reference plane is half an angle θ2 of an optical axis

extending from the image pickup device toward the reference plane.

13. The distance measuring apparatus according to claim 12, wherein the angle θ2 is 90°.

14. The distance measuring apparatus according to claim 9, wherein the movement amount computation section obtains a plurality of optical flows from the reference plane image data, and wherein, by performing Hough transform using the coordinates of the start points and the coordinates of the end points of at least two of the obtained optical flows, the movement amount computation section computes the amount of movement of the mobile unit.

15. An object detection method for detecting an object on a reference plane using an image pickup device, wherein relative positions of the object and an object detection apparatus change on the reference plane, the method comprising:

cutting an image received by the image pickup device such that the image pickup device receives an image that is divided into a reference plane image and an object image by a predetermined boundary, wherein the reference plane image contains the reference plane, and wherein the object image contains the object and does not contain the reference plane;

obtaining reference plane image data corresponding to the reference plane image and object image data corresponding to the object image from image data obtained by the image pickup device;

computing relative positions of the object and the object detection apparatus on the reference plane based on an optical flow obtained from the reference plane image data and an optical flow obtained from the object image data.

16. The method according to claim 15, wherein the image pickup device is mounted on a mobile unit that moves on the reference plane, the method further comprising:

computing an amount of movement of the mobile unit relative to the reference plane based on an optical flow obtained from the reference plane image data; and

computing a distance from the mobile unit to the object based on an optical flow obtained from the object image data and the computed amount of movement.

17. The method according to claim 16,

wherein, when the amount of movement is computed, a plurality of optical flows are obtained from the reference plane image data, and Hough transform is performed using the coordinates of the start points and the coordinates of the end points of at least two of the obtained optical flows.

18. The method according to claim 17, wherein, when an image received by the image pickup device is cut, a reflecting body having a reflecting surface is located in a part of the image pickup area of the image pickup device such that an image reflected by the reflecting surface of the reflecting body becomes the object image received by the image pickup device.

19. The method according to claim 18, wherein an angle θ1 of the reflecting surface relative to the reference plane is half an angle θ2 of an optical axis extending from the image pickup device toward the reference plane.

20. The method according to claim 19, wherein the angle θ2 is 90°.